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## Computer Systems

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### *Convener - Lola Olsen*

In addition to the discussions, Ocean Climate Data workshop hosts gave participants an opportunity to hear about, see, and test for themselves some of the latest computer tools now available for those studying climate change and the oceans. Six speakers described computer systems and their functions. The introductory talks were followed by demonstrations to small groups of participants and some opportunities for participants to get hands-on experience. After this familiarization period, attendees were invited to return during the course of the Workshop and have one-on-one discussions and further hands-on experience with these systems. The following are brief summaries or abstracts of introductory presentations.

### **NASA's Climate Data System (NCDS)**

#### **Lola Olsen**

Ms. Olsen subtitled her presentation, "NCDS and Its Evolution as Goddard's Distributed Active Archive Center (DAAC)". She described the data flow and noted that a new interface had been installed. This interface allows communications directly with the database. NCDS also has direct access to data from the metadata. She described how a search is performed and various features of the system. The system uses the Common Data Format (CDF). This saves time, space, allows for portability and the inclusion of metadata along with the data, and eases comparisons among data sets. Procedures for verification were described. Examples were given as to what a user might find when performing a search and analysis of data. Finally, the results of the most recent version of NCDS have shown a boost in research productivity (in both the volume and quality). The system provides a feedback loop and maintenance has decreased. Future plans call for project support to various climate related projects, development of CD-ROMs, and evolution within the Goddard Distributed Active Archive Center (DAAC) of the Global Change Data Center for the Earth Observing System Data and Information System (EOSDIS).

Systems Data and Information System (EOSDIS), and eventually becoming a Global Change Data Center.

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## **Oceanographic Data Analysis in the Goddard Laboratory for Hydrospheric Processes**

**Anthony J. Busalacchi**

Dr. Busalacchi described the large number and variety of ocean climate analyses that are being performed by NASA's Laboratory for Hydrospheric Processes. The work he discussed and illustrated included GEOSAT topography and other altimetric analyses. Surface winds and wind stress analyses from SSM/I were shown, as well as analyses using historical data such as COADS. Ocean color work originally developed using Nimbus 7/Coastal Zone Color Scanner (CZCS) data were shown and they are now preparing for the SEAWIFS satellite which is scheduled to be launched in 1993. A number of analytical projects in the higher latitudes were described including polar processes work on sea ice and surface temperature and ice thickness from radar altimetry data. A number of these applications were then demonstrated at the hands-on session that followed the talk. Climate ocean analyses conducted at Goddard include both global and basin scale studies - some observational, some modeling and may be interconnected through the computer systems demonstrated.

### **SEAPAK, An Oceanographic Analysis Software Package**

**Charles McClain**

SEAPAK consists of some 280 programs in a menu-driven system. It was originally designed to operate in a VAX/VMS environment, but there is now also a PC version called PC-SEAPAK. This system was designed for analysis of Coastal Zone Color Scanner (CZCS) imagery and can also be used to process AVHRR images. The system contains an extensive on-line data base of world wide meteorological and oceanographic data. The Transportable Applications Executive (TAE) interface used is "user friendly". All programs are written in Fortran. The system, which is hardware dependent, uses the International Imaging Systems (IIS) Model 75 display system. SEAPAK is now being ported to the UNIX environment. The PC version was written for a 386/20 and can process both CZCS and AVHRR data. A number of analysis tools were described, illustrated and later demonstrated. The VAX-based system operates on a large number of data sets and is very flexible. Collaborative efforts with NCDS in acquiring and translating data into a common format were cited as a key component in research productivity.

## **Project POSEIDON, the NODC On-Line Database**

**Peter J. Topoly**

The U.S. National Oceanographic Data Center (NODC) has under development a relational database system for in-situ marine biogeochemical parameters. The system is intended to replace the mainframe-oriented NODC master files. The first phase of this development, Project POSEIDON, is being undertaken to demonstrate the capabilities and possibilities of such a system. The first prototype was completed in 1991. POSEIDON has been developed using a client-server architecture consisting of a DEC VAX cluster and a Teradata 700 data base engine. The relational model used to store, manage, and access data is a simple approach keyed to individual marine data parameters. Each parameter is keyed or linked to other parameters by a complex, yet straightforward, set of metadata. There is nothing particularly unique about the POSEIDON database model. What separates POSEIDON from other systems is the philosophy behind its development. The POSEIDON database is not being implemented as an application, but rather as a fast powerful data supplier to other applications. A graphical user interface system, PEGASUS, is the link between the database and the user. This interface is being developed in three phases: an internal LAN version for NODC data management; a network version for Internet and dial-in access; and a stand-alone version for personal computers and workstations. The latter implementation, coupled with a POSEIDON database on a CD-ROM, will provide the climate researcher with a powerful, yet simple desktop tool. Beta testing of PEGASUS will begin in the spring of 1992.

## **A Microcomputer World Ocean Atlas of Hydrography, Nutrients and Chemical Tracers for the IBM PC AND Macintosh**

**Peter Rhines and Elizabeth Smith**

The oceanographic atlas is one of the main tools of the oceanographer (Stommel and Fieux, 1978). Paper atlases have long been used at sea to provide a context for newly acquired hydrographic sections, but these atlases are limited in their presentation. *Atlas*, for the IBM PC, and *OceanAtlas*, for the Macintosh II, are microcomputer applications which provide a simple means for browsing and manipulating hydrographic and tracer data using widely available hardware. *Atlas* was developed by Professor Peter Rhines (School of Oceanography, University of Washington), and *OceanAtlas* was developed from the IBM PC version by John Osborne (NOAA/PMEL) and James Swift (Scripps Institution of Oceanography).

Both application allow one to load oceanographic sections into a memory and plot them as "stacked" vertical profiles with superimposed color contouring of a second variable. The sections may then be browsed; plotting of individual stations or arbitrary subsets of stations, moving up and down moving up and down a

single cast to look at numerical values, or watching the inner construction of contemporaneous property plots. A variable size map window, with a plot of the cruise track, is visible at all times. Section plots may be reshaped or sized to highlight a particular feature.

The Macintosh and IBM PC versions are each unique in certain ways. The IBM PC version allows a customized section to be constructed by tagging stations from any number of sections, sorting the results and writing a new disk file. This new section may then be plotted. A much improved user interface graces the Macintosh version. Both versions allow new sections to be imported into the application specific format by means of a utility provided with the package.

Atlant is distributed on 5/3.5" high density diskettes with a User's Guide and includes approximately 100 sections. It requires an IBM-class microcomputer with CGA, EGA, or VGA graphics capabilities. An 80386-based IBM clone is ideal but an IBM-AT class machine is adequate.

OceanAtlas is distributed on 2/3.5" double density diskettes with a User's Guide and includes approximately 50 sections. It requires a Macintosh computer with 68020 or 68030 microprocessor and a color monitor which can display at least 16 colors. An SE30 with an auxiliary color monitor works fine, as will any of the Macintosh II family. Both packages are available, at no cost, from the JPL Physical Oceanography Archive Center. Please contact us at the addresses listed below. Atlant and OceanAtlas are both available free-of-charge from the JPL Physical Oceanography Distributed Active Archive Center. Please contact the Archive Center at: Mail Stop 300-320 Jet Propulsion Laboratory 4800 Oak Grove Drive Pasadena, CA 91109 Attention: Ruby Lassanyi Phone: (818)354-0906 Fax:(818)393-6720

## **GRADS - A New System for Data Analysis**

**James Kinter**

Dr. Kinter described and demonstrated a tool for analysis of meteorological and oceanographic data that has recently been developed at the University of Maryland. The Grid Analysis and Display System (GRADS) has been designed to operate on four dimensional gridded data sets or on station data (both oceanographic and meteorological stations). The system allows for spacial and temporal filtering. Charts, maps, or animations may be displayed. The system uses X-Windows and may be used on a variety of workstations.

**SEAKPAK Vugraphs**

***SEAPAK***

***An Oceanographic Analysis Software Package***

by

Charles R. McClain

Oceans & Ice Branch  
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# SEAPAK

## Satellite & In-Situ Data Analysis Package

- **VAX-SEAPAK (GSFC only)**
  - 10 Years of Development
  - Over 275 Analysis Programs
    - CZCS & AVHRR satellite data
      - Ingest, calibrate, process level-2, project, register, average*
    - Hydrographic data (e.g. NODC station data, Levitus climatologies, drifters)
      - Mean profiles, vertical & horizontal sections, density computations, etc.*
    - Meteorological data (e.g. FNOC winds, NDBC mooring data)
      - Wind stress, Ekman upwelling, Sverdrup transport, streamlines etc.*
    - Over 50 data sets on-line (CDFs & VMS index files)
    - Statistical Analysis & Math Transformations
      - Freq. distributions, EOF's, MEM transforms, arithmetic functions, etc.*
- **PC-SEAPAK (distributed)**
  - CZCS & AVHRR Analyses Only
  - 115 Analysis Programs in Menu
- **UNIX-SEAPAK (under development)**

# SEAPAK

## Major Program Categories

1. Level 1 tape ingestion
2. Level 2 processing
3. Environmental data processing
4. Projection and registration
5. Graphics overlaying
6. Image data retrieval
7. Image arithmetic functions
8. Image statistics
9. IIS image processing
10. General utilities
11. DSP system support

## SEAPAK Functionality

- Image and Overlay Graphics Manipulation.
  - Image : save, restore, looping, editing, rescaling, false color and color bar generation.
  - Overlays : annotate, area-of-interest (blotches).
- Image File Manipulation.
  - Interactive data display and extraction.
  - Gray-level to geophysical value conversion.
  - ASCII image data generation.
  - Image merging.
- Geographic Programs.
  - Support twenty different projections.
  - Image registration.
  - Coastlines and grids and labels on an image.

## SEAPAK Functionality

- Level-1 Data Ingestion.
  - NOAA or NASA/GSFC CRT tape format for CZCS.
  - NOAA/NESDIS LAC and GAC tape formats for AVHRR.
  - Subsampling or duplicating of pixels.
  - Consecutive full resolution scene ingestion.
  - Interactive extraction from full resolution scene.
  - Output files : image files, control point file and log file.
- CZCS Level-2 Data Processing.
  - Level-2 products :
    - Subsurface water radiance at 443, 520 and 550 nm.
    - Aerosol radiance at 670 nm.
    - Rayleigh radiance at 443 nm.
    - Diffuse attenuation at 490 nm.
    - Pigment concentration.
  - Flexible algorithm and parameter selections.

# SEAPAK Functionality

- Mathematical Programs.
  - Arithmetic and logarithm functions.
  - Time series and scattergram plots.
  - Statistics : histogram, power spectrum analysis, autocorrelation and cross correlation.
- Ancillary Data Set Processing.
  - Ingest data into indexed or CDF format.
  - Interactive query for data extraction and listing.
  - Plotting : vector plot, X/Y plot, time series, contours, profiles, maps.
  - Image generation.
- Utilities.
  - Miami DSP file format support.
  - Color hard-copy on HP PaintJet printer.
  - Non-standard SEAPAK image file display.

## SEAPAK ANCILLARY DATA

- O Approx. 100 independent parameters supported
- O On-line query by parameter, program, file name
- O Gridded data in NASA Common Data Format (CDF)
  - Model outputs: FNOC, ECMWF, NMC winds, NOAA SST
  - Climatologies: Hellerman stress, COADS, Levitus mixed layer depths, Southern Ocean atlas
  - Fields experiments: FGGE winds, ISCCP clouds
- O Ungridded data in VAX/VMS indexed files
  - NODC products: stations, current meters, XBT
  - Field experiments: Sequal/Focal Nansen cast, FGGE drifters
- O Software capabilities
  - Gridded fields: SEAPAK images, contour/vector maps, time series at a point, ASCII lists
  - Ungridded fields: profiles, sections, OA, maps, lists
  - Interfaces: GEMPAK, Surfer/Grapher, spreadsheets

## User Interface

### VAX SEAPAK – Transportable Applications Executive (TAE)

- Developed at GSFC; used by many other applications.
- Menu and command modes.
- On–line help; save and restore of input parameters.
- Batch job submission and access to DCL.
- Supports variety of computers and systems.

### PC–SEAPAK – TAE–like interface

- Extracted from GSC's PCGEMS and enhanced by GSC.
- Menu and command modes.
- On–line help; save and restore of input parameters.

## Transportable Applications Executive

- Developed at GSFC; used by many other systems such as GEMPAK, LAS.
- Provides uniform interface to all SEAPAK programs.
- Menu and command modes for program invocation and data entry.
- Tree structure of menus allows efficient organization of a large number of programs.
- Dynamic parameter menus and prompting.
- Parameter values may be saved for easy recall.
- Allows access to operating system.
- Interactive, asynchronous, or batch execution of programs.
- On-line help for all commands, programs, and input parameters.
- Repetitive commands may be automated.

## Image Display System

### VAX SEAPAK – International Image System (IIS) Model 75

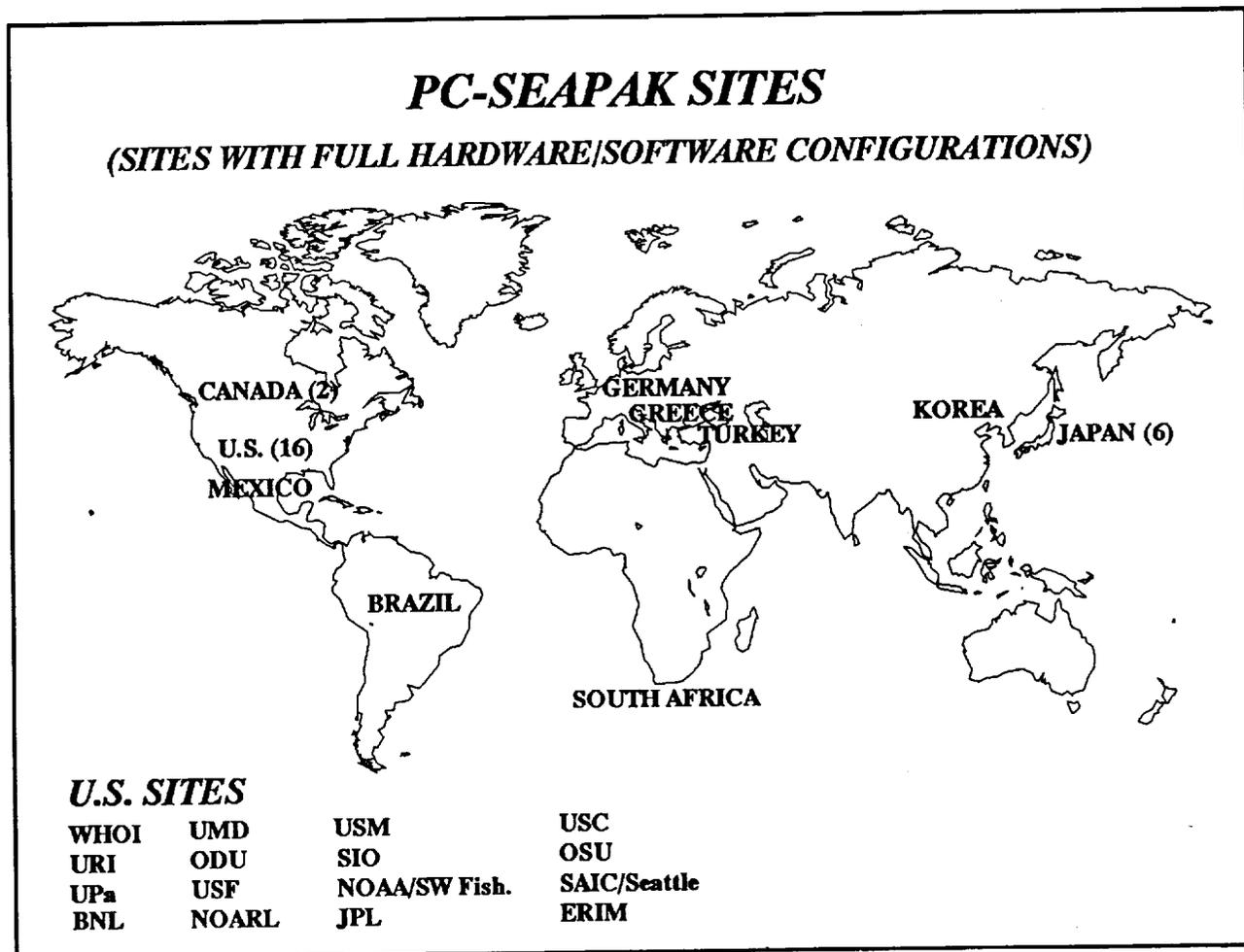
- Interlaced display.
- Sixteen 512x512x8 bits channels
  - 14 for images, 2 for graphics.
- Eight independent and non-destructive overlay graphics planes.
- Red, green and blue LUTs for each channel.
- Programmable hardware controlled track ball cursor.
- Keypad (15 function keys) and foot pedal.
- Hardware functions : pan, scroll, zoom, windowing, arithmetic operations, histogram, and convolution.

## Image Display System

### PC-SEAPAK – Matrox MVP-AT board

- Interlaced and non-interlaced display.
- Four 512x512x8 bits frame buffers
  - 3 for images, 1 for graphics.
- Seven non-independent and non-destructive overlay graphics palettes.
- Red, green and blue LUTs for each frame buffer.
- No hardware cursor support.
- Hardware functions : pan, scroll, zoom, windowing, arithmetic operations, histogram, and convolution.





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